

Average to Instantaneous

We define the function to be graphed

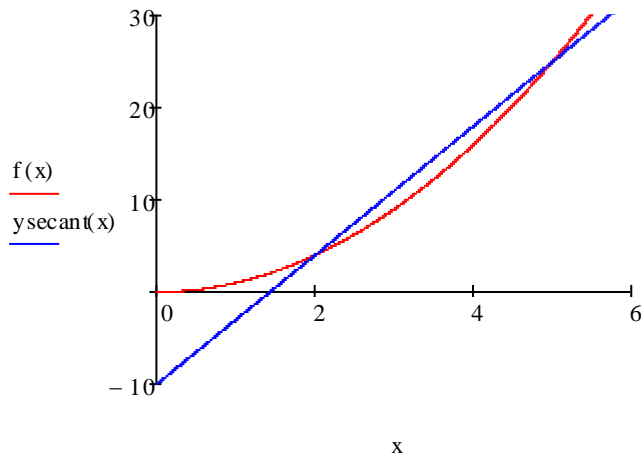
$$f(x) := x^2$$

We define the secant line. We start by defining h which will be the variable we animate and allow to decrease so that the secant line becomes the tangent line at $x = 2$. I'm going to define $a = 2$ even though I don't have to but I want to create a template that could be used at any point.

$$h := 3 - \frac{\text{FRAME}}{10} \quad a := 2$$

$$y_{\text{secant}}(x) := \frac{f(a+h) - f(a)}{h} \cdot (x - a) + f(a)$$

In the x direction I used a range $[0,6]$ and on the vertical $[-10,30]$

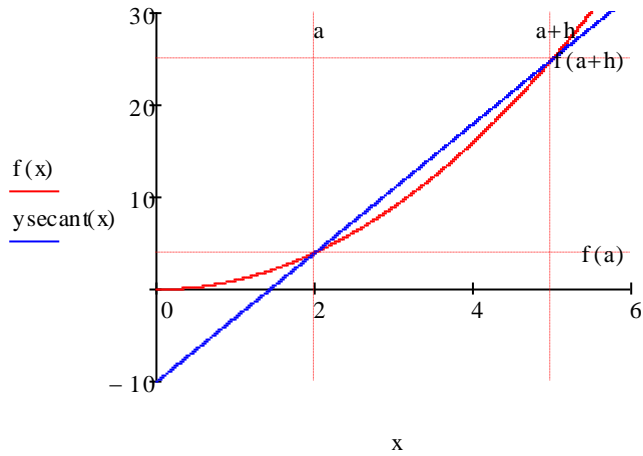


Now we turn on show markers and put a and $a+h$ on the horizontal and $f(a)$ and $f(a+h)$ on the vertical.

Also type $\frac{f(a+h) - f(a)}{h} =$ and $h =$ above the graph to show the approximation to the derivative as h decreases.

$$h = 3$$

$$\frac{f(a+h) - f(a)}{h} = 7$$



Now Animate using 29 frames since $h = 3 - \frac{\text{FRAME}}{10}$ and $\frac{f(a+h) - f(a)}{h}$ is undefined at $h = 0$.

Make sure you include

$$\frac{f(a+h) - f(a)}{h} = \text{ and } h = \text{ when you highlight to animate}$$